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THE WORK OF THE NEWLANDS RECLAMATION PROJECT EXPERIMENT FARM IN 1919

By F. B. HEADLEY
Farm Superintendent

Residence of the Superintendent of the Newlands Experiment Farm

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AGRICULTURAL CONDITIONS ON THE PROJECT.

CROP PRODUCTION AND VALUE.

In 1919 the net area under irrigation on the Newlands project was increased from 42,311 to 44,324 acres, which is an increase of 4.8 per cent over that of the previous year. The area devoted to alfalfa was increased from 25,277 to 28,042 acres, an increase of nearly 11 per cent. The areas planted to barley, oats, and potatoes were smaller than in 1918.

About 63 per cent of the total crop area of the project is in alfalfa, but this area produces about 80 per cent of the total crop valuation. Alfalfa is the great money crop, and upon it depends the more important live-stock industries. As shown in Table I, the value of the alfalfa produced in 1919 was $1,485,600, while wheat, which ranks second, was worth but $166,532.

The average gross income per acre to the farmers has nearly quadrupled since 1914, not so much because of the more efficient production but mostly on account of the increased market values of the crops. The average income derived by the farmers for each acre of crop produced since 1911 has been as follows:

1912	$12.83	1916	$20.11
1913	12.92	1917	35.90
1914	11.22	1918	38.43
1915	15.39	1919	42.54

Table I is compiled from data collected by the United States Reclamation Service. It shows the acreage, yields, and market values of all leading crops produced on the Newlands project in 1919.

TABLE I.—*Acreage, yields, and farm values of crops produced on the Newlands Reclamation Project in 1919.*

Crop.	Area (acres).	Unit of yield.	Yields.		Farm values.		
			Total.	Average per acre.	Per unit of yield.	Total.	Average per acre.
Alfalfa hay	24,188	Ton...	92,850	3.84	$16.00	$1,485,600	$69.42
Alfalfa (planted in 1919)	3,854	...do..	817	.21	16.00	13,072	3.39
Barley	519	Bushel	10,875	21.0	1.45	15,769	30.38
Oats	31	...do..	937	30.2	.90	843	27.20
Wheat	5,423	...do..	83,266	15.4	2.00	166,532	30.70
Potatoes	152	...do..	24,366	160.3	1.50	36,549	240.45
Hay (except alfalfa)	351	Ton...	345	.98	15.00	5,175	14.74
Garden and miscellaneous crops	701	.....	.....	.....	.....	95,113	135.68
Pasture:							
Alfalfa	.....	.....	.....	.....	.....	43,327	.....
All other	10,247	.....	.....	.....	.....	23,914	2.33
Irrigated without crop	1,028	.....	.....	.....	.....	.....	.....
Total	46,494	.....	.....	.....	.....	1,885,894	42.54
Less duplications	2,170	.....	.....	.....	.....	.....	.....
Net acreage	44,324	.....	.....	.....	.....	.....	.....

In order to ascertain the progress made in the production of the leading crops, Table II has been prepared, showing the acreage and production of alfalfa, barley, oats, wheat, and potatoes from 1912 to the present time. It will be noted that the production of alfalfa has gradually and steadily increased, while the acreage devoted to all other crops has been subject to marked fluctuations. Wheat alone has shown a steady increase since 1914. Only about 1,000 acres of alfalfa land were broken up for other crops in 1919, while nearly four times that acreage was newly sown to alfalfa.

TABLE II.—*Acreage and production of leading crops on the Newlands Reclamation Project in the 8-year period from 1912 to 1919, inclusive.*

Year.	Alfalfa.		Barley.		Oats.		Wheat.		Potatoes.	
	Acres.	Tons.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.
1912	12,912	33,595	2,259	74,792	399	16,875	2,484	40,600	483	65,633
1913	13,960	45,132	1,880	43,238	283	19,274	1,590	30,271	416	29,789
1914	13,212	59,873	1,329	31,084	417	18,000	1,446	29,164	283	23,800
1915	18,273	53,496	1,733	49,585	428	14,375	2,582	54,065	196	25,133
1916	19,541	61,756	1,658	52,000	107	4,566	2,861	57,733	177	29,400
1917	20,360	72,769	1,116	26,833	27	938	2,532	43,233	322	56,433
1918	21,542	77,442	1,374	35,333	44	1,856	5,024	98,800	334	50,833
1919	24,188	92,850	519	10,875	31	937	5,423	83,266	152	24,366

LIVE-STOCK PRODUCTION.

There has been a very decided decrease in the number and total estimated value of the live stock on the project. Only the poultry and stands of bees have been increased. This decrease in the number of live stock is probably associated with the high prices and comparatively large profits to be derived from the production and direct

sale of farm crops. The dairy and hog industries, especially, are attractive only when highly profitable and are subject to decline when satisfactory profits can be made from the direct sale of alfalfa and other feeds. The actual decline in the number of dairy cattle has been very slight, and there are indications that the best cows are being retained. This weeding out of the poorer animals may be expected to result in the development of superior dairy herds.

In Table III are compiled data concerning the number and value of live stock on the Newlands Reclamation Project in December, 1919, compared with similar data for the previous year. These figures are quoted from the annual report of the United States Reclamation Service. It will be noted that there has been an actual decrease in the value of live stock of all kinds amounting to $24,790.

TABLE III.—*Number and estimated value of live stock on the Newlands Reclamation Project in 1918 and 1919.*

Item.	Inventory, Dec. 31 (number)—				Values in 1918.		Values in 1919.			
	1918	1919	1919							
			Increase.	Decrease.	Unit.	Total.	Unit.	Total.	Increase.	Decrease.
Horses	3,394	3,256	.....	138	$79.25	$268,990	$80.40	$261,785	.....	$7,205
Mules	340	276	.....	64	76.47	26,000	74.05	20,440	.....	5,560
Cattle:										
Dairy	1,895	1,850	.....	45	91.71	173,785	99.61	184,285	$10,500	.....
Other	8,839	6,778	.....	2,061	42.51	375,790	48.92	331,620	.....	44,170
Sheep	3,560	3,347	.....	213	10.80	38,464	10.34	34,612	.....	3,852
Hogs	3,343	3,048	.....	295	15.01	50,194	14.48	44,137	.....	6,057
Fowls:										
Turkeys	4,746	3,442	.....	1,304	3.15	14,928	3.94	13,563	.....	1,365
All other	20,220	25,932	5,712	.....	.92	18,538	.97	25,232	6,694	.....
Bees, hives	1,589	2,821	1,232	.....	13.23	21,029	16.73	47,254	26,225	.....
Total	.....	.....	.....	.....	.....	987,718	.....	962,928	43,419	68,209
Net decrease	.....	.....	.....	.....	.....	.....	.....	.....	.....	24,790

WEATHER CONDITIONS.

Weather records are kept in cooperation with the United States Weather Bureau, the Biophysical Laboratory of the Bureau of Plant Industry, and the University of Nevada. In 1919 the frost-free period was 15 days longer than normal, the last killing frost in spring occurring May 6 and the first in autumn on September 22. A light frost occurred on the morning of June 1, which nipped the leaves of tender plants in low or exposed situations, but as very little damage was reported it was not classed as a killing frost. The mean temperature for the four summer months was somewhat higher than usual. The season was exceptionally favorable for the growth of alfalfa, fruit, and those products of the field and garden which thrive best in hot weather. Because of the long, hot growing season practically all varieties of corn were able to become thoroughly

matured. Irrigation water was plentiful, so there was no loss from water shortage. The total precipitation was 3.98 inches, which is 82 per cent of normal. The observations for the year 1919 and the average of all years since observations were begun are presented in Table IV.

TABLE IV.—*Summary of climatological observations at the Newlands Experiment Farm for the 14-year period from 1906 to 1919, inclusive.*

PRECIPITATION (INCHES).

Year, etc.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Average for 14 years [1]	0.80	0.47	0.40	0.56	0.45	0.34	0.20	0.16	0.40	0.35	0.25	0.49
For 1919	T.	.93	.35	.40	.36	.00	.09	.00	.73	.18	.20	.74

EVAPORATION (INCHES).

Average for 12 years [2]	1.21	1.80	4.15	6.21	8.27	10.00	10.86	9.75	6.61	3.92	2.05	0.94
For 1919	.577	1.624	4.00	6.30	9.41	10.43	11.60	10.07	7.23	3.84	1.597	.614

DAILY WIND VELOCITY (MILES PER HOUR).

Average for 11 years [3]	3.2	3.8	4.7	5.3	4.9	4.1	3.3	3.0	3.0	2.7	2.8	2.7
For 1919	1.3	3.8	4.6	4.3	3.1	2.6	2.0	1.6	2.3	2.2	2.0	1.9

ASPECT OF THE SKY (DAYS).

Average for 14 years [4]												
Clear	13.1	13.0	17.8	17.9	17.8	22.5	23.1	24.9	22.3	23.1	17.9	14.5
Partly cloudy	9.5	7.7	7.7	7.4	9.1	4.4	5.2	3.9	4.0	3.1	6.0	7.0
Cloudy	8.4	7.5	5.5	4.7	4.1	3.1	2.7	2.2	3.7	4.8	6.1	9.5
For 1919:												
Clear	24.0	8.0	12.0	10.0	16.0	26.0	28.0	26.0	21.0	21.0	20.0	16.0
Partly cloudy	4.0	10.0	9.0	13.0	13.0	4.0	2.0	5.0	6.0	6.0	8.0	8.0
Cloudy	3.0	10.0	10.0	7.0	2.0	.....	1.0	.....	3.0	4.0	2.0	7.0

TEMPERATURE (°F.).

Year, etc.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Average for 14 years: [5]												
Absolute maximum	57.9	63.6	73.8	81.2	87.9	95.4	100.1	98.9	91.6	82.6	72.8	61.3
Daily maximum	42.9	49.4	58.7	66 7	72.4	83.3	92.9	91.6	80.2	67.6	55.5	44.2
Absolute minimum	− 0.6	7.4	16.2	20.6	28.1	36.1	44.1	41.0	30.2	19.9	9.2	3.4
Daily minimum	17.4	23.3	28.0	34.9	40.5	47.3	54.3	51.7	42.8	32.9	23.9	18.6
Monthly mean	30.0	36.2	43.3	50.7	56.4	65.3	73.5	71.5	61.4	50.3	39.7	31.3
14 year record:												
Highest recorded	70.0	72.0	79.0	89.0	102.0	101.0	105.0	103.0	95.0	89.0	81.0	72.0
Lowest recorded	−25.0	−12.0	9.0	13.0	21.0	31.0	38.0	36.0	26.0	13.0	− 1.0	− 4.0
For the year 1919:												
Absolute maximum	63.0	60.0	72.0	84.0	97.0	97.0	103.0	102 0	89.0	76.0	71.0	63.0
Mean maximum	44.6	46.8	56.5	68 5	81.0	86.8	96.6	94.1	80.6	60.6	52.3	41.0
Absolute minimum	− 4.0	13.0	14.0	19.0	30.0	31.0	45.0	42.0	33.0	13.0	.0	− 4.0
Mean minimum	13.6	26.7	27.7	34.8	45.3	45.0	55.6	52.0	40.8	28.5	19.2	16.4
Mean	29.1	36.8	42.0	51.7	63.2	65.9	76.1	73.0	60.7	44.6	35.8	28.7

[1] January, February, and March, 13 years.
[2] January and February, 9 years; March, 11 years.
[3] January, February, March, April, and November, 10 years.
[4] January, February, March, and October, 13 years.
[5] March and October. 13 years.

TABLE IV.—*Summary of climatological observations at the Newlands Experiment Farm for the 14-year period from 1906 to 1919, inclusive*—Continued.

KILLING FROSTS.

Year.	Last in spring.		First in autumn.		Frost-free period (days).
	Date.	Day of year.	Date.	Day of year.	
1906	May 31	151	Oct. 4	277	126
1907	May 14	134	Sept. 19	262	126
1908	May 30	150	Sept. 25	268	118
1909	May 24	144	Sept. 22	265	121
1910	May 16	136	Sept. 23	256	120
1911	May 27	147	Sept. 18	261	114
1912	May 22	142	Sept. 25	268	126
1913	May 13	133	Sept. 23	266	133
1914	Apr. 24	114	Sept. 9	252	138
1915	May 20	140	Sept. 14	257	117
1916	June 1	152	Sept. 10	253	101
1917	May 21	141	Sept. 25	268	127
1918	May 29	149	Oct. 7	280	131
1919	May 6	126	Sept. 22	265	139
Average	May 20	140	Sept. 22	265	125

CHARACTER OF THE WORK IN PROGRESS.

In 1919 the work of the Newlands Experiment Farm, which is located about 1 mile south of the town of Fallon, Churchill County, Nev., consisted of (1) recording the weather conditions at the Experiment Farm, (2) variety tests of general farm crops, (3) variety tests of horticultural crops, (4) field experiments in the reclamation of alkali soil, and (5) laboratory work relating to local problems in crop production. In previous years from 30 to 50 acres were planted annually on private farms, consisting of varietal and horticultural tests of the farm crops of greatest economic value for this project. Because of a lack of funds this work and also the cooperative work with farmers in keeping temperature records was discontinued.

VARIETAL AND CULTURAL TESTS OF FIELD CROPS.

BARLEY VARIETY TESTS.

Six varieties of barley were planted on March 24 on plats H–14 and H–15. All varieties used were grown in the variety tests of the previous year. In all previous years the variety tests of barley have been conducted on private farms on plats that were seldom less than one-quarter acre in size, but in 1919 all cooperative work with farmers was abandoned and it was necessary to plant on small plats, each having an area of 0.074 acre. All varieties were planted in duplicate. The borders were planted to wheat, which was cut out with a scythe before the barley was ripe. A blank space of 2 feet was left between varieties. The varieties were harvested July 11 and thrashed July 23. It will be noted that the yields in 1919, as given in Table V, were very low, but the rank of the varieties is the same as for the previous year and varies but little from the 5-year average, which is also shown in the table.

TABLE V.—*Tests of six varieties of barley grown on the Newlands Experiment Farm in the 5-year period from 1915 to 1919, inclusive.*

Variety.	Results in 1919.						Summary for the 5-year period.						
	Rank.	Actual yield (pounds).			Yield per acre.		Yields per acre (pounds).					Average.	
		Series I.	Series II.	Average.	Pounds.	Bushels.	1915	1916	1917	1918	1919	Pounds.	Bushels.
Coast	1	79.0	80.4	79.7	1,077	22.4	2,040	1,765	979	2,436	1,077	1,659	34.6
Trebi	2	72.8	61.8	67.3	909	18.9	.....	.....	1,135	1,926	909	1,323	27.6
Chevalier	3	67.6	57.4	62.5	845	17.6	.....	1,504	833	1,726	845	1,227	25.6
Svanhals	4	71.1	48.1	59.6	805	16.8	1,435	1,408	842	1,672	805	1,232	25.7
Hannchen	5	59.6	54.4	57.0	770	16.0	1,581	1,456	1,040	1,645	770	1,298	27.0
Nepal	6	36.8	31.3	34.1	460	9.6	1,218	1,292	510	1,570	460	1,010	21.0

WHEAT VARIETY TESTS.

Eight varieties of wheat were planted March 10 on plats H–1 and H–2. Each of these plats was subdivided into twelve smaller ones, each having an area of 0.022 acre. Plantings were made in triplicate. The borders were planted to barley, which was cut with a scythe before the wheat was ripe. Soon after the wheat was up, a sand storm cut the leaf blades back to the ground, and the crop was seriously damaged. The varieties were harvested July 18 and thrashed five days later.

It will be noted that there is a decided variation between the rank of the varieties in 1919 and the 5-year average, which may have resulted from the fact that the windstorm in early spring did not damage all of the subplats in an equal degree. Table VI presents the results of the 1919 experiment and the yield of all varieties except Early Baart for a period of five years. As noted in previous reports, Little Club is the most productive variety and should be planted when wheat for feeding purposes is desired, but it is not so desirable as hard wheat for milling purposes.

TABLE VI.—*Tests of varieties of wheat grown on the Newlands Experiment Farm in the 5-year period from 1915 to 1919, inclusive.*

Variety.	Results in 1919.							Summary for the 5-year period.							
	Rank.	Yield per plat (pounds).				Yield per acre.		Rank.	Yields per acre (bushels).						
		Series I.	Series II.	Series III.	Total.	Pounds.	Bushels.		1915	1916	1917	1918	1919	Total.	Average.
Bluestem	1	15.0	22.4	23.6	61.0	924	15.4	6	38.5	42.1	37.2	37.0	15.4	170.2	34.0
Little Club	2	14.1	24.1	21.0	59.2	897	15.0	1	45.5	52.2	50.8	47.1	15.0	210.6	42.1
Defiance	3	19.1	17.4	20.0	56.5	856	14.3	4	39.0	42.8	44.3	37.0	14.3	177.4	35.5
Dicklow	4	12.8	19.2	20.4	52.4	794	13.2	3	41.6	42.3	51.1	37.8	13.2	186.0	37.2
Sonora	5	9.4	18.7	21.8	49.9	756	12.6	5	40.5	37.2	46.2	35.4	12.6	171.9	34.4
Rieti	6	10.5	20.3	15.1	45.9	695	11.6	2	42.7	48.5	45.2	39.2	11.6	187.2	37.4
Early Baart	7	15.8	10.4	15.3	41.5	629	10.5	.....	.....	.....	.....	.....	10.5	.....	.....
Marquis	8	7.2	9.3	17.8	34.3	520	8.7	7	37.3	40.9	51.0	29.5	8.7	167.4	33.5

EXPERIMENTS WITH POTATOES.

The potato industry on the Newlands project suffered a marked decline in 1919, probably because of the increasing prevalence of Fusarium blight, which renders unmarketable a large percentage of the tubers. Only 152 acres were reported as having been planted in 1919. Unless means are found and adopted for effectually controlling this disease it will be impossible for the potato industry to reach a position of importance among the crops of the project.

OUTLINE OF THE EXPERIMENTS.

The potato experiments on the Newlands Experiment Farm included (1) tests of time of planting; (2) tests of distance of planting; (3) comparison of whole and cut seed, size of seed pieces, and size of seed tubers; (4) variety tests; (5) treatment of eelworm-infected seed.

The yields obtained during the season of 1919 were for some reason much lower than the average of former years. All the experiments except the variety test were either duplicated or triplicated.

TIME-OF-PLANTING TESTS.

Plantings were made for six consecutive weeks, beginning with April 15. This experiment has been conducted in a similar manner for a period of three years. In 1919 the test was carried on in duplicate, each row being 120 feet long. The yields reported (Table VII) are for marketable tubers only.

TABLE VII.—*Time-of-planting tests with potatoes on the Newlands Experiment Farm in 1917, 1918, and 1919.*

Time of planting.	Yields per 100-foot row (pounds).				Time of planting.	Yields per 100-foot row (pounds).			
	1917	1918	1919	Average.		1917	1918	1919	Average.
April 15 to April 19	84	94	32	70	May 6 to May 10	86	98	26	70
April 22 to April 26	99	124	35	86	May 13 to May 17	102	75	49	75
April 29 to May 3	111	86	31	76	May 20 to May 24	72	71	19	54

In 1919 the yield obtained from the planting made on May 13 was decidedly higher than the others. In the two tests of previous years the highest yields were obtained from plantings made about the first of May. To judge from the results of the three years, it seems that it is safe to plant potatoes from the middle of April to the middle of May, but plantings made after the latter date are likely to be less productive.

DISTANCE-OF-PLANTING TESTS.

In this experiment seed pieces were dropped in the row at distances of 6, 12, 18, and 24 inches. The average yields per 100 feet of row are given in Table VIII. There is a gradual decline in total production as the distance of planting is increased, but when the market-

able tubers are considered it is seen that the distance of planting does not so materially affect the result. There is a tendency for the culls to increase with the closer planting. The indications are that the usual planting distance of 18 inches is approximately correct.

TABLE VIII.—*Distance-of-planting tests with potatoes on the Newlands Experiment Farm in 1919.*

Distance of planting in row.	Yields per 100-foot row (pounds).		
	Marketable.	Culls.	Total.
6 inches	81	33	114
12 inches	72	28	100
18 inches	81	17	98
24 inches	65	20	85

PREPARATION OF SEED TESTS.

This experiment was conducted for the purpose of comparing the use of whole, halved, and quartered seed and of tubers of different sizes on the yield of the resulting crop. In comparing whole, halved, and quartered seed, tubers for seed as nearly uniform in size as possible were selected. Plantings were made in triplicate. The average yield of usable potatoes and the percentage of stand obtained are shown in Table IX.

In this experiment the whole seed produced better than the cut seed and the halved seed better than the quartered. In an experiment of this character, where unequal quantities of seed are used according to the size of the seed pieces, it is necessary to calculate the net yield by subtracting the weight of the seed planted from the actual yield. The net yields per 100-foot row are shown in the last column of the table.

TABLE IX.—*Preparation of seed tests with potatoes on the Newlands Experiment Farm in 1919.*

Character of seed used.	Stand (per cent).	Results per 100-foot row (pounds).		
		Seed used.	Yields.	
			Gross.	Net.
Tubers nearly uniform in size:				
Whole seed	91	14	89	75
Cut seed—				
Halved	90	7	63	56
Quartered	89	4	57	53
Tubers of different sizes:				
Large—				
Whole	67	31	46	15
Cut	66	7	46	39
Medium—				
Whole	72	13	37	24
Cut	74	5	20	15
Small—				
Whole	79	7	27	20
Cut	72	3	22	19

. In that part of these experiments wherein the size of the seed tubers was taken into consideration, the potatoes were graded into large, medium, and small. By small tubers is meant those weighing less than 4 ounces; medium tubers, those weighing from 4 to 8 ounces; and large tubers those weighing more than 8 ounces. Whole and cut seed of the three grades was prepared and planted in triplicate. The results are shown in Table IX.

The planting of whole seed of large potatoes does not appear to be advisable, because of the greater quantity of seed used. Large potatoes cut produced a decidedly higher net yield than either medium or small seed either whole or cut.

Whole seed of medium-sized potatoes returned a slightly larger net yield than either medium or small seed cut and also a larger yield than from the small potatoes planted whole. It appears that the use of small seed is not so profitable as the use of larger seed.

POTATO VARIETY TESTS.

Ten varieties of potatoes were grown on the experiment farm in 1919. There was considerable difference in the relative yields or rank of the varieties for this year and for the two previous years. In 1919 the Irish Cobbler gave the highest returns, although during a period of five years the average yield of this variety was the lowest of seven on trial.

The details of the variety test for 1919 are given in Table X, which also includes a summary of the average yields and rank of seven varieties for five years. The Burbank, as a rule, appears to be the highest yielding variety, but it has the disadvantage of producing more second growth than any of the others.

TABLE X.—*Variety tests of potatoes on the Newlands Experiment Farm for the 6-year period from 1914 to 1919, inclusive.*

Variety.	Results in 1919.				Summary for the 6-year period.							
	Yields per 100-foot row (pounds).			Stand (per cent).	Rank.	Yields per 100-foot row (pounds).						
	Marketable.	Culls.	Total.			1914	1915	1916	1917	1918	1919	Average.
Irish Cobbler	63	12	75	85	7	25	26	27	65	133	63	56
Early Freeman	52	7	58	68	6	41	21	43	91	106	52	59
Producer	55	11	66	88	.....	.....	.....	.....	.....	.....	.....	.....
Burbank	55	11	66	91	1	30	50	40	147	154	55	79
American Wonder	50	16	66	82	3	.....	50	44	99	96	50	68
Earliest of All	45	9	54	72	2	61	51	26	140	108	45	72
Colorado Pearl	46	7	53	80	4	27	43	45	120	116	46	66
Netted Burbank	34	6	40	57	.....	.....	.....	.....	.....	.....	.....	.....
Blue Victor	25	6	31	70	5	36	25	33	.....	186	25	61
Scotch Rose	17	7	24	68	.....	.....	.....	.....	.....	.....	.....	.....

TREATMENT OF EELWORM-INFECTED SEED.

The experiment with seed potatoes infected with eelworms was conducted according to the plan followed in 1918. Potatoes heavily infected with eelworms were selected for seed and given treatment by heat for varying lengths of time and at different temperatures. The plantings were made in duplicate, and noninfected potatoes were planted every third row. These check rows were used as a measure of the productiveness of the land area between any two rows, and the yields of the infected seed were calculated in percentages of the yields of the two nearest check rows. The soil was not uniformly productive, and this method increases the accuracy of the results over what they would be without the use of the check rows.

It appears that treatments of 30° C. for 24 hours and possibly of 35° C. for 12 hours were beneficial and resulted in a better stand and higher yield. In general, it may be considered that prolonging the heat treatment or increasing the temperature to more than 40° C. has the effect of reducing the yield.

EFFECT OF THE TREATMENT OF SEED POTATOES INFECTED WITH EELWORMS UPON THE INFECTION OF RESULTING CROPS.

In Table XI the results of the eelworm count of the crop grown from infected seed which had been given various treatments are given in detail. In counting, the potatoes were divided into four classes according to the degree of infection: (1) No infection, (2) light, (3) medium, and (4) heavy infection. In order to make it possible to compare the efficiency of one treatment with another they were scored so that a single number represented the relative infection. The scoring is performed by deducting from 100 per cent for each 1 per cent infection as follows: Heavy infection, 1 per cent; medium infection, two-thirds of 1 per cent; light infection, one-third of 1 per cent; no infection, no deduction.

It is interesting to note that there was a light infection even in the check rows in which seed free from eelworms was used. The average score of the check rows was 95 per cent. It is not known whether this infection resulted from eelworms originally in the soil, or in the seed used, or from migrations of eelworms from the rows adjoining where infected seed was used. A measure of the efficiency of the treatments is obtained by comparing the scores of the infested rows with the scores of the nearest check rows. In the last column of Table XI it is seen that the infection was greater than that in the check rows for the following treatments: Untreated, 30° C. for 24 hours, 35° C. for 12 hours, 35° C. for 24 hours, and 45° C. for 12 hours. All the remainder of the treatments appeared to be 100 per cent efficient in so far as eelworm infection was concerned.

TABLE XI.—*Effect of the treatment of seed potatoes infected with eelworms upon the infection of the resulting crop at the Newlands Experiment Farm in 1919.*

Treatment of seed (temperature data in ° C.).	Number tubers, counted.	Potatoes infected.								Score.	Score of adjoining check rows.	
		Number.				Per cent.						
		None.	Light.	Medium.	Heavy.	None.	Light.	Medium.	Heavy.		Average.	Deviation of treated rows.
Check	200	158	40	1	1	79.0	20	0.5	0.5	92½	.....	.....
Untreated	200	116	65	14	5	58.0	32.5	7.0	2.5	82	93	−11
Held at 30° for 24 hours	200	128	49	11	12	64.0	24.5	5.5	6.0	82	95	−13
Check	200	179	19	1	1	89.5	9.5	.5	.5	96	.....	.....
Held at 35° for 12 hours	200	122	64	11	3	61	32	5.5	1.5	84	96	−12
Held at 35° for 24 hours	200	133	59	8	0	66.5	29.5	4.0	0	87½	95	− 7½
Check	200	170	29	1	0	85.0	14.5	.5	0	95	.....	.....
Held at 35° for 48 hours	117	110	6	1	0	94.0	5.0	0	0	98	95	+ 3
Held at 40° for 6 hours	200	178	21	1	0	89.0	10.5	.5	0	96	96	+ 1
Check	200	171	28	1	0	85.5	14.0	.5	0	95	.....	.....
Held at 40° for 12 hours	172	163	9	0	0	95.0	5.0	0	0	98	95	+ 3
Held at 40° for 24 hours	182	165	17	0	0	91.0	9.0	0	0	97	95	+ 2
Check	200	170	28	2	0	85.0	14.0	1.0	0	95	.....	.....
Held at 40° for 36 hours	145	129	12	4	0	89.0	8.0	3.0	0	95	95	0
Held at 45° for 6 hours	121	105	15	1	0	87.0	12.0	1.0	0	95	94	+ 1
Check	200	166	33	1	0	83.0	16.5	.5	0	94	.....	.....
Held at 45° for 12 hours	58	46	10	2	0	79.5	17.0	3.5	0	92	94	− 2

TESTS OF HORTICULTURAL CROPS.

EFFECT OF ACID PHOSPHATE ON TOMATOES.

For the experiment to show the effect of acid phosphate 20 plants of Earliana tomatoes were set in each of 15 rows. The yields of the two border rows were determined, but not considered in estimating the results of this experiment. In the remaining 13 rows, alternate rows were used as checks and received no treatment. The remaining rows were treated with acid phosphate, as shown in Table XII. The fertilizer was weighed and applied by mixing it with the earth around each plant.

It will be noted that only a small percentage of the plants matured tomatoes. The loss was due to Fusarium blight, which was prevalent and caused greater losses in tomatoes in 1919 than in any previous year. The loss was greater among the fertilized plants than among those in the check rows, the average loss being 51 per cent in the check rows and 61 per cent in the fertilized rows.

The total yield of the six fertilized rows was 370 pounds, or 62 pounds per row, and the yield of the seven check rows was 474 pounds, or 68 pounds per row. This reduction in yield by the addition of the acid phosphate was the result of the increased loss of plants by disease rather than an actual lessening of the yield, for the average yield per plant of the fertilized rows was 7.9 pounds and of the check rows 6.9 pounds. It is probable, therefore, that the addition of acid phosphate would be found beneficial during seasons when Fusarium blight is not prevalent. This one experiment is not, of course, suffi-

cient to prove that there is a relationship between the addition of the phosphate and the loss of the plants by Fusarium blight.

TABLE XII.—*Effect of the application of acid phosphate on the growth and yield of tomatoes at the Newlands Experiment Farm in 1919.*

Row.	Treatment.	Number of plants.		Loss of plants (per cent).	Yield (pounds).	
		Set.	Maturing.		Total.	Per plant.
No. 1	Border	20	4	80	42	10.5
No. 2	Check	20	5	75	59	10.9
No. 3	Phosphate, 1 ounce per plant	20	6	70	73	12.2
No. 4	Check	20	10	50	121	12.1
No. 5	Phosphate, 2 ounces per plant	20	7	65	75	10.4
No. 6	Check	20	10	50	97	9.7
No. 7	Phosphate, 3 ounces per plant	20	7	65	83	11.8
No. 8	Check	20	11	45	70	6.4
No. 9	Phosphate, 1 ounce per plant	20	8	60	62	7.8
No. 10	Check	20	11	45	52	4.7
No. 11	Phosphate, 2 ounces per plant	20	9	55	39	4.3
No. 12	Check	20	12	40	34	2.8
No. 13	Phosphate, 3 ounces per plant	20	10	50	38	3.8
No. 14	Check	20	10	50	41	4.1
No. 15	Border	20	18	10	61	3.4

SWEET-CORN VARIETY TESTS.

Seven varieties of sweet corn were tested on the experiment farm in 1919. They were planted in duplicate by hand. The results are shown in Table XIII.

TABLE XIII.— *Yields of sweet-corn varieties on the Newlands Experiment Farm in 1919.*

Rank.	Variety.	Yield (pounds).			Total length of rows (feet).	Weight per 100-foot row (pounds).
		Row I.	Row II.	Total.		
1	Black Mexican	95	93	188	539	35
2	Early Sugar	105	81	186	539	34.5
3	Peep o'Day	54	99	153	539	28.4
4	Country Gentlemen	98	35	133	539	24.7
5	Golden Bantam	79	38	117	479	24.4
6	Columbus Market	33	52	85	539	15.8
7	Narrow-Grained Evergreen	22	37	59	539	11.0

The Black Mexican variety leads in production, with Early Sugar a close second. Narrow-Grained Evergreen gave the smallest yields per 100 feet of row. The ranks of the varieties differ somewhat from the previous year. In 1918 the Country Gentlemen gave the largest yields, with the Black Mexican second. On account of its dark color the Black Mexican does not look as pleasing as the other varieties, especially when canned.

BLOSSOMING DATES OF FRUIT VARIETIES.

During the 4-year period, 1916–1919, inclusive, blossoming records have been kept of all trees in field A–4. It is interesting to note the great variation from year to year in the dates of the first opening of the buds. The average date of the opening of the first blossoms of the apple trees in the orchard have been as follows: 1916, 19 trees,

April 17; 1917, 21 trees, May 7; 1918, 21 trees, April 29; 1919, 19 trees, April 23. (Table XIV.)

The trees are in full bloom from five to nine days after the first blossoms appear.

TABLE XIV.—*Blossoming dates of fruit-tree varieties on the Newlands Experiment Farm during the 4-year period, 1916 to 1919, inclusive.*

Row, tree number, and kind.	Variety.	Buds first open.			
		1916	1917	1918	1919
Row I:					
1 (apple)	Arkansas Black	Apr. 17	May 7	Apr. 30	Apr. 25
2 (apple)	Ben Davis	Apr. 20	...do	Apr. 29	Apr. 23
3 (apple)	Akin	Apr. 17	...do	Apr. 30	Do.
4 (apple)	Ralls	Apr. 22	May 12	May 5	
5 (apple)	Sierra	Apr. 20	May 7	Apr. 30	Apr. 22
6 (apple)	Shackleford	...do	...do	...do	Apr. 23
7 (apple)	Babbitt	Apr. 14	...do	Apr. 26	Apr. 22
8 (apple)	Banana	Apr. 20	...do	Apr. 28	Do.
Row II:					
1 (apple)	Coos	Apr. 18	...do	Apr. 30	Apr. 25
2 (apple)	Opalescent	Apr. 20	May 10	May 1	Do.
3 (apple)	Yellow Bellflower	Apr. 13	...do	Apr. 27	Do.
4 (apple)	Gano	Apr. 20	...do	Apr. 28	Do.
5 (apple)	Red Astrachan	Apr. 13	May 4	Apr. 26	Apr. 23
6 (apple)	Golden Sweet	Apr. 18	May 7	May 1	Apr. 24
7 (apple)	Mann		May 1	...do	Apr. 23
8 (crab)	Hyslop	Apr. 13	...do	Apr. 28	
Row III:					
2 (apple)	Wismer	Apr. 14	May 5	...do	Apr. 25
4 (apple)	Waxen	Apr. 13	May 6	Apr. 29	Apr. 23
Row IV:					
1 (crab)	Transcendent		Apr. 30	Apr. 19	
2 (apple)	Winter Banana	...do	May 10	Apr. 30	Apr. 12
3 (apple)	Haas	Apr. 30	...do	May 2	Apr. 25
Row V:					
1 (pear)	Barry		Apr. 25	Apr. 20	Apr. 18
2 (pear)	Kieffer		Apr. 30	Apr. 15	Apr. 14
3 (pear)	Worden			Apr. 20	Apr. 16
Row VI:					
1 (pear)	Easter Beurre		Apr. 13	Apr. 18	Apr. 18
2 (plum)	Climax		Apr. 20	Apr. 17	
3 (prune)	Sugar		Apr. 26		Apr. 16

VARIETIES OF FRUIT TREES TO PLANT.

Many inquiries come in each year, chiefly from new settlers, asking for information in regard to the varieties of fruit trees best adapted to this region. The varieties mentioned in the lists below are generally known to be successfully grown on the Newlands project. Undoubtedly many other desirable varieties will be added in the next few years. No attempt is made to present a complete list of desirable varieties, but it is intended to name those which are known to be successful. Mr. C. G. Swingle has kindly assisted by furnishing a list of varieties producing most satisfactorily on his ranch. Those shown in black-faced type are recommended for first choice.

APPLES.

Summer varieties.—**Yellow Transparent, Red June,** Red Astrachan, Maiden Blush, Early Harvest.

Fall and early-winter varieties.—**Wagener, Wealthy,** Early Melon, McIntosh Red.

Winter varieties.—**Black Ben, Gano, Delicious, Jonathan, King David,** Banana, Yellow Bellflower, Grimes (*Grimes Golden*), Winesap.

APRICOTS.

Apricots are not recommended for extensive planting, as they are frequently caught by the late spring frosts.

CHERRIES.

Some of the common sour varieties fruit nearly every season, but the sweet cherries are less reliable bearers. Of the sour varieties, plant Early Richmond, Montmorency, and May Duke. Some growers will wish to plant some of the large sweet varieties for the pleasure of having them during favorable seasons. For this purpose Black Tartarian, Napoleon (*Royal Anne*), and Bing are suggested.

PEARS.

The Bartlett pear is an excellent variety, but is subject to blight. The Kieffer is productive, but the quality is not so good as the Bartlett. Other varieties suggested are Duchess, Flemish Beauty, Seckel, and Winter Nelis.

PEACHES.

Peaches are not reliable bearers in this climate, but during favorable seasons they bear heavily and produce fruit of excellent flavor. Desirable varieties are **Crawford Late, Illinois, Elberta,** Mayflower, Early Wheeler (*Red Bird Cling*), Muir, and Phillips Cling.

PLUMS.

Plums are quite regular bearers, and a fair crop can be expected from some varieties in most seasons. Few varieties have been tested, and the following recommendations may therefore be materially changed within the next few years: **Omaha,** American, Blue Damson, Compass Cherry.

GRAPES.

Grapes are grown successfully on the bench lands and on the heavier soils of the Island and Stillwater districts. On some of the lighter soils away from the river they have not been so satisfactory. **Concord,** Diamond, and Worden are recommended.

EXPERIMENTS IN THE RECLAMATION OF ALKALI SOIL.

EFFECT OF MANURE ON CROP YIELDS.

This experiment was begun in 1917 and has for its object the determination of the effect of manure added biennially upon the reclamation of the alkali soil of field E. The crops used are wheat, fodder corn, and mangels.

TABLE XV.—*Effect of manure on yields of crops growing on alkali soil on the Newlands Experiment Farm in 1919.*

Crop and plat number.	Year manured.	Unit of yield.	Yield per acre.	Percentage of increase.
Silage corn:				
No. 1	1917 and 1919	Ton	3.96	1.8
No. 2	Not manured	do	3.89	
Wheat:				
No. 3	1918	Bushel	19.3	6.1
No. 4	Not manured	do	18.2	
No. 5	do	do	8.9	6.7
No. 6	1917 and 1918	do	9.5	6.7
Mangels:				
No. 7	Not manured		No crop	
No. 8	do		do	

In 1918 greatly increased yields were obtained from the plats which had been manured. In 1919 there was also an increase in production resulting from the manuring, but it was not so great as in 1918. The results in detail for the year 1919 are shown in Table XV. Wheat yields were increased 6.1 and 6.7 per cent and corn yields 1.8 per cent.

ALKALI RECLAMATION EXPERIMENTS IN FIELD Y.

In 1914 various treatments were given to a series of 18 plats in field Y. This field was very alkaline over the greater part of the area. In past reports it has been shown that the treatments given had the effect of materially increasing the yield of alfalfa. In the fall of 1918 nine of the checks were plowed and the treatments of

FIG. 1.—Applying gypsum by means of the manure spreader. This apparatus is very satisfactory for this purpose. Sufficient manure is put in the bottom of the spreader to carry the gypsum.

gypsum and manure that had been given in 1914 were repeated (fig. 1). In the spring of 1919 these nine plats were seeded to barley. The results are compiled in Table XVI.

It will be noted that there was an increased yield of 80 per cent for the first treatment, a decrease of 1 per cent for the second treatment (this decrease being due to an unusually bad area in plat 4), and an increase of 17 per cent for the third treatment.

The remaining nine plats in field Y, plats 10 to 18, inclusive, were allowed to remain in alfalfa in 1919. In this case, as in all previous experiments reported, there was a decided increase in yield as a result of the treatments (Table XVI). Because of the extremely spotted character of the soil, one would not be justified in drawing conclusions as to the relative efficiency of the treatments used, but there can be no doubt that gypsum on this type of soil is decidedly beneficial.

The treatments so far given, however, have not raised the yield to the point of profitable production.

TABLE XVI.—*Alkali reclamation experiment in growing barley and alfalfa on field Y of the Newlands Experiment Farm in 1919.*

Crop and plat number.	Treatment.	Yields in 1919.			
		Per acre (pounds).	Treated plats.		
			Average (pounds).	Increase over adjacent check plats.	
				Pounds.	Per cent.
Barley:					
No. 1	Tile, gypsum, manure	302	441	197	80
No. 2	Check	244			
No. 3	Tile, gypsum, manure	580			
No. 4	Tile, gypsum, manure	394	628	−6	−1
No. 5	Check	634			
No. 6	Tile, gypsum, manure	854			
No. 7	Gypsum, manure	1,235	1,225	175	17
No. 8	Check	1,050			
No. 9	Gypsum, manure	1,215			
Alfalfa:					
No. 10	Gypsum	4,233	3,078	2,845	1,220
No. 11	Check	233			
No. 12	Gypsum	1,922			
No. 13	Tile, gypsum, manure, sweet clover	1,167	1,173	366	45
No. 14	Check	807			
No. 15	Tile, gypsum, manure, sweet clover	1,178			
No. 16	Sulphuric acid	1,100	1,050	1,050	.....
No. 17	Check	0			
No. 18	Sulphuric acid	1,000			

ALKALI RECLAMATION EXPERIMENTS IN FIELD B.

The alkali reclamation experiments were located in plats 9 and 10 of field B, where the soil is of such a nature that seeds germinate with difficulty and the plants which do emerge grow to a height of only a few inches during the season. After each irrigation the surface of the untreated soil cements over, forming a hard crust.

The two large plats, B–9 and B–10, were each divided into 20 small plats, each having an area of 12 by 45 feet, or 0.0124 of an acre. After the treatments were made, each plat was plowed and harrowed separately. Wheat was seeded in all plats with a grain drill. When the grain was mature it was cut by hand, put into sacks, and allowed to dry in the air, after which it was weighed on delicate balances. The weights given include both grain and straw. The details of this experiment are given in Table XVII, the rank of each treatment according to actual yields being shown in the right-hand column.

Manure had a decidedly beneficial effect wherever used. (Figs. 2 and 3.) When used in combination with sulphur, gypsum, or acid phosphate, the yields were generally greater than when manure was

used alone. Chemicals, alone or in combination, improved the soil to some extent, but they were not usually so effective as the manure. Manure applied at the rate of 2,800 pounds per plat did not appear to be so effective as when used in smaller quantities.

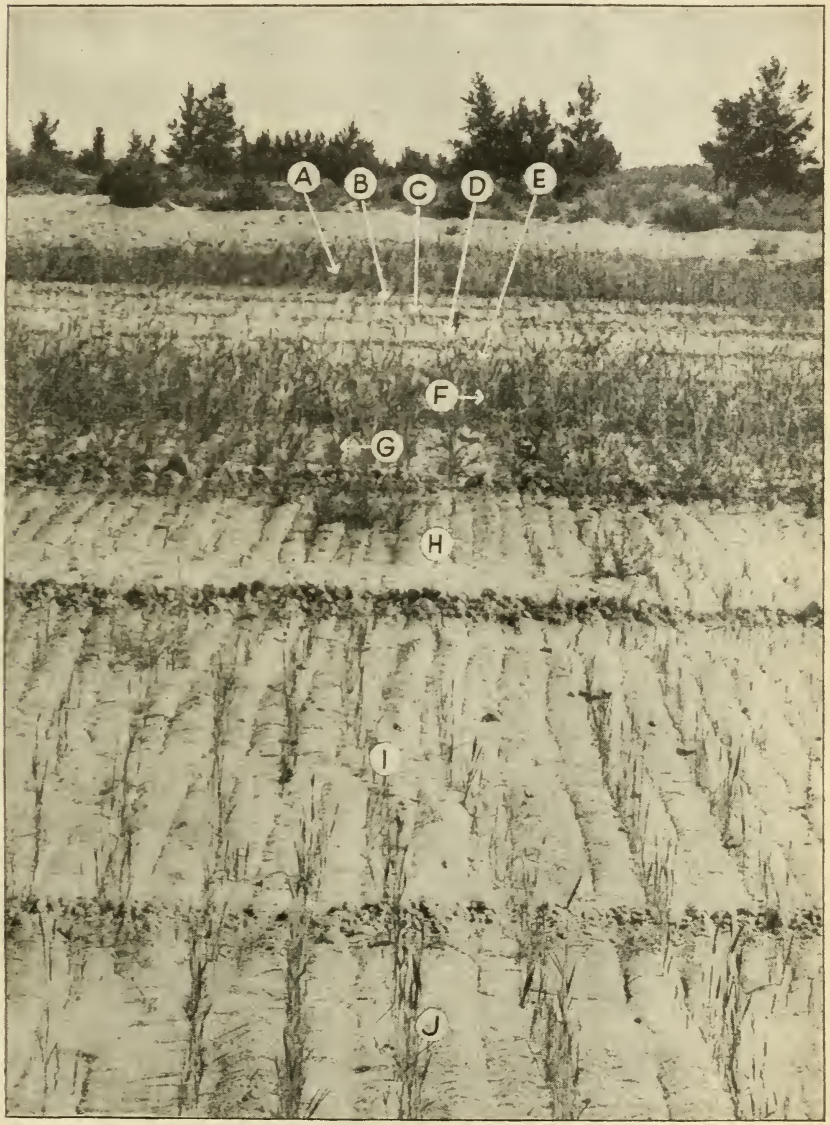

FIG. 2.—Results of alkali-reclamation experiments on plat B-9. Note the beneficial effect of manure wherever used. Gypsum, acid phosphate, and sulphur were only beneficial. Key to treatments: *A*, Manure; *B*, phosphate and gypsum: *C*, phosphate and sulphur; *D*, check; *E*, phosphate; F, phosphate, gypsum, and manure; *G*, phosphate, sulphur, and manure; *H*, check; *I* and *J*, gypsum.

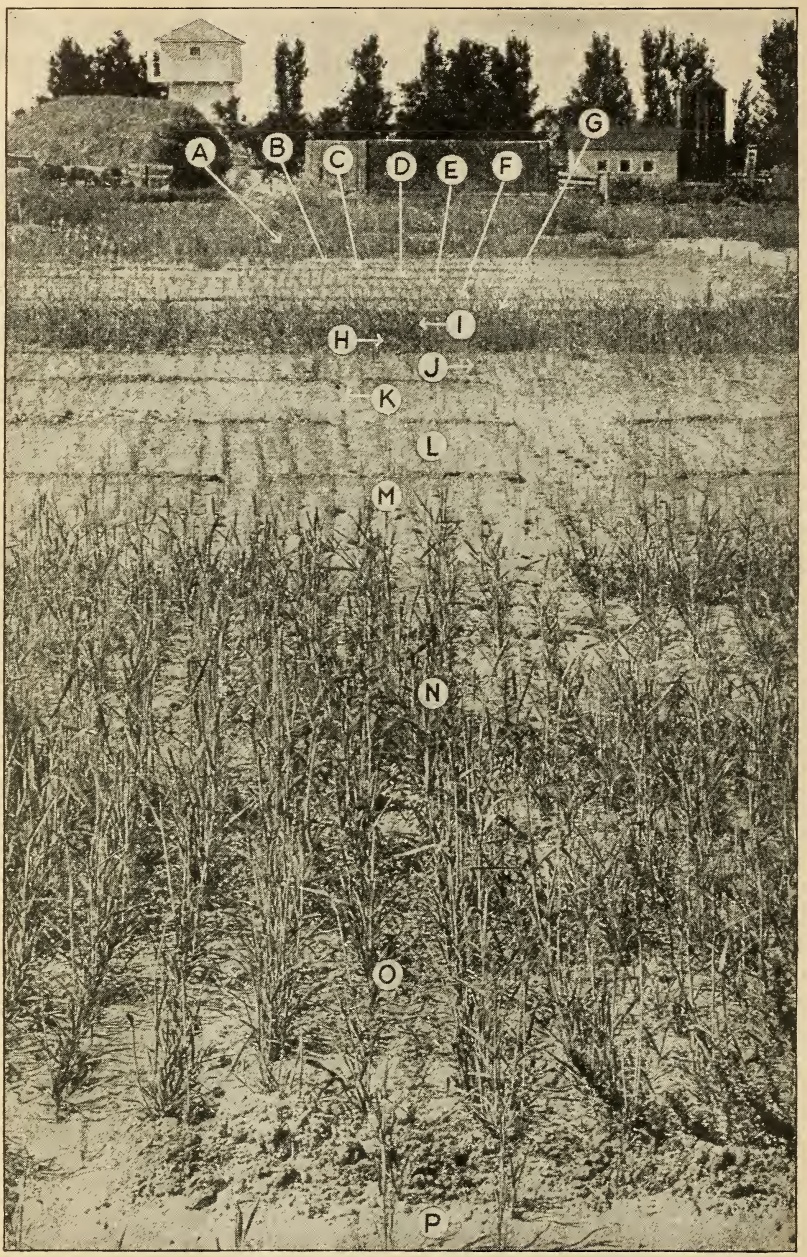

FIG. 3.—Results of alkali-reclamation experiments on plat B–10. Note the beneficial effect of manure wherever used. Gypsum, acid phosphate, and sulphur were only slightly beneficial. Key to treatments *A*, Manure; *B*, check; *C* and *D*, sulphur; *E* and *F*, gypsum; *G*, check; *H*, phosphate, sulphur, and manure; *I*, phosphate, grysum, and manure; *J*, phosphate; *K*, check; *L*, phosphate and sulphur; *M*, phosphate and gypsum; *N*, manure and phosphate; *O*, manure and sulphur; *P*, check.

TABLE XVII.—*Effect of various soil treatments on the growth of wheat in field B of the Newlands Experiment Farm in 1919.*

[The average yield of 9 check plats was 0.46 pound.]

Plat, subdivision, and treatment.	Yield (pounds).			Rank.
	Series I.	Series II.	Total.	
Plat B–9:				
Check	0.31	0.25	0.56	
Gypsum 110 pounds	.44	.38	.82	12
Gypsum 28 pounds	.38	.25	.63	14
Sulphur 28 pounds	.31	.25	.56	15
Sulphur 7 pounds	.38	.44	.82	13
Check	0	.38	.38	
Manure 700 pounds	.75	3.06	3.81	6
Manure 1,400 pounds	.44	3.38	3.82	5
Manure 2,800 pounds	.94	2.06	3.00	10
Manure 1,400 pounds, gypsum 28 pounds	3.00	3.13	6.13	2
Check	1.25	1.00	2.25	
Plat B–10:				
Check	1.25	.25	1.50	
Manure 1,400 pounds, sulphur 14 pounds	4.56	3.44	8.00	1
Manure 1,400 pounds, acid phosphate 4 pounds	2.75	2.25	5.00	3
Gypsum 28 pounds, acid phosphate 4 pounds	2.88	.56	3.44	7
Sulphur 14 pounds, acid phosphate 4 pounds	2.75	.50	3.25	9
Check	.56	.13	.69	
Acid phosphate 4 pounds	1.25	.50	1.75	11
Acid phosphate 4 pounds, gypsum 28 pounds, manure 1,400 pounds	1.81	2.44	4.25	4
Acid phosphate 4 pounds, sulphur 14 pounds, manure 1,400 pounds	1.00	2.38	3.38	8
Check	[a]4.31	.25	.25	

[a] This figure is not used in computing the average, as part of the plat contained good soil.

The toxicity of the soil in these plats was due to the presence of a small quantity of sodium carbonate. Other alkali salts were present in quantities too small to prove toxic. A soil sample was taken in the center of each plat before any manure or chemical had been added. The average amount of alkali salts present in the 40 samples thus obtained is shown in Table XVIII.

TABLE XVIII.—*Alkali salts present in the soil in the alkali reclamation experiment in field B of the Newlands Experiment Farm before treatment in 1919.*

Salt.	Plat B–9.		Plat B–10.	
	1 foot.	2 feet.	1 foot.	2 feet.
Na_2CO_3	0.072	0.050	0.065	0.054
$NaHCO_3$	.80	.081	.072	.077
NaCl	.012	.010	.012	.009
Na_2SO_4	0	0	0	0